Knowledge of Connectors as Cohesion Devices in Text: A Comparative Study of Native English and ESL Speakers

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Knowledge of connectors as linguistic devices for establishing intersentential coherence was examined in three experiments. Native English and English-as-a-Second-Language (ESL) speakers completed a rational cloze task in which they chose among instances of four types of connectors: additives, causals, adversatives, and sequentials. The close completion responses of all students were more frequently correct for additive and causal slots than for adversative and sequential. However, the native English speakers were more confident of their correct adversative and sequential responses (~~Experiment~~ 2). Verbal explanations of the correct responses indicated that both native English (~~Experiment 1~~) and ESL students (~~Experiments 1 and 3~~) were aware of prescriptive usage rules and the differences in function and meaning among the four types of connectors. Analyses of the incorrect responses indicated a general tendency to overuse causal, and to a lesser extent, additive connectors. This was especially true for the ESL students

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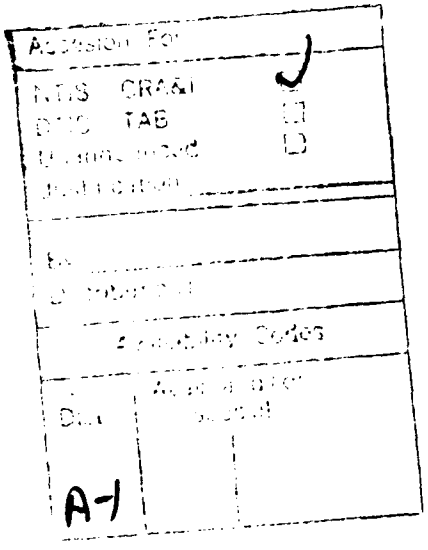
19. Abstract continued

at lower levels of English language proficiency. Furthermore, verbal response justifications for incorrect answers (Experiments 1 and 3) indicated that the majority of errors were due either to inaccurate processing of the text or to an inability to choose the connector that fit an inappropriately inferred relation. The results are discussed in terms of the processing demands of the various types of connectors and the influence of everyday usage of causal and additive connectors on how individuals use and understand such terms. Implications for improving the design of content-domain texts are provided and instructional strategies for use with ESL students are suggested.



Knowledge of Connectors as Cohesion Devices in Text: A Comparative Study of Native English and ESL Speakers

A primary method of acquiring new information is through reading. This process involves understanding the relations among the clauses and sentences that make up a passage, and results in a representation of the information that is organized and logically coherent. There are several types of rhetorical devices that may be used in text to make explicit the logical structure of the information. Some devices signal the global organization of the passage (e.g., *titles, headings and subheadings*); others indicate the function of a paragraph (e.g., *In summary*); and others function at a more local level conveying the relationship between successive clauses or sentences in a text (e.g., predicate connectors such as *however, in addition, because*). (For discussions of signalling see Lorch, (in press) and Meyer (1975).)

Passages vary in the degree to which the inter- and intrasentential relations contained therein are made explicit. In the absence of explicit signals to logical relationships we rely on a "conversational postulate" for text: we infer cohesion based on the default assumption that successive sentences are related, making use of other cohesion devices such as referential and lexical overlap (Halliday & Hasan, 1976; Kintsch & van Dijk, 1978; MacLean & D'Anglejan, 1986). Research on the role of prior knowledge in text comprehension suggests that the outcome of this inference process depends on the amount of knowledge the reader has in the domain of the discourse (Goldman & Durán, 1988; Voss, 1984). When the reader has little knowledge in a domain and is reading to learn about the domain, the presence of signals that cue logical relationships among sentences would seem to be particularly important.

Connectors, or conjunctives (Halliday & Hasan, 1976), are a type of cohesion device that make explicit the logical relations among sentences. Common connectors include *and, but, however,* and *because.* Such connectors are of limited utility, however, unless the reader understands how connectors function in text and the logical relationship each specifies. This aspect of language proficiency is particularly important to students who acquire English as a second language (ESL) and are attempting to learn from English language texts. Success for

these students in the university setting is in part determined by the ability to learn from text. One focus of the present research was the levels of proficiency with connectors that might be characteristic of ESL populations. Although we were able to find only one study that examined ESL students' use of connectors to establish cohesion in text (MacLean & d'Anglejan, 1986), anecdotal reports from teachers of ESL students frequently indicate that learning the appropriate use of connectors is an extremely difficult aspect of the English language. To a lesser extent, this can also be said of native English speakers. For example, in a study of good and poor readers, Bridge and Winograd (1982) found that both groups found it more difficult to justify cohesive ties established with connectors compared to those established with referential and lexical cohesion devices; however, good readers were better able to justify their responses than were poor readers.

Studies examining the use of connectors by readers of different skill levels have yielded mixed results regarding the relationship between connector understanding and language proficiency. Some studies have found that the presence of connectors in text is no more helpful to good readers than to poor readers (e. g., Meyer, Brandt, & Bluth, 1980) but others report differential effects. For example, Geva and Ryan (1985) found that positive effects of including connectors occurred for both groups when the conjunctions were included and highlighted in the text but only for the skilled readers when the conjunctions were present in the text but not highlighted. Furthermore, Geva and Ryan (1985) found that the omission of connectors negatively affected less-skilled readers but had no effect on skilled readers.

Other researchers have examined whether difficulty level of the text impacts the role of connectors and have found no relationship (Spyridakis & Standal, 1987). MacLean & d'Anglejan (1986) examined the role of text difficulty on advanced ESL learners' ability to establish intersentential coherence. They presented students with a rational cloze task in which three types of cohesive items had been deleted, including conjunctive items. (The rational cloze task contrasts with the traditional cloze task where the deletion scheme is based on number of

intervening words (e.g., delete every fifth word). MacLean & d'Anglejan found that text difficulty did not affect advanced ESL learners' ability to complete the rational cloze task.

The equivocal nature of the results of prior research regarding language proficiency and connectors is in part due to the sampling of connectors. It seems reasonable that some interclausal and intersentential relations may be easier to infer than others and the benefits of including explicit connectors may be differential. In addition, grammar textbooks for ESL students typically devote large sections to sentence and clause connectors, providing elaborate taxonomies of connectors. For example, Celce-Murcia and Freeman (1983) have provided a functional classification scheme for logical connectors that differentiates among four major types of connectors: additive, causal, adversative, and sequential. The first three typically relate to interclausal or intersentential relations. Additive relations are those that signal some form of elaboration of previous content (e. g., *In addition, That is*). Cause-effect or antecedent-consequent relations are signalled by causal connectors (e.g., *As a result, Due to*). Adversative connectors signal contrastive elaborations (e.g., *However, On the contrary*). Sequential connectors are used to signal a more diverse set of logical relations and refer to the larger discourse context more often than do the other connectors. Sequential connectors are used to enumerate lists of items (e.g., *First, Second, Finally*), to mark a sentence that previews the remainder of the text (e.g., *In short*) or to indicate temporal sequence of events (e.g., *Subsequently, Later*). In previous studies, investigators have not systematically controlled or manipulated the relation that the reader must infer. For example, Spyridakis and Standal (1987) sampled a heterogeneous set of logical relations. In other cases, effects of different kinds of connectors remain unknown because the sample of specific connectors was not indicated and/or data were collapsed across all connectors (e.g., Bridge & Winograd, 1982; Geva & Ryan, 1985; MacLean & d'Anglejan, 1986).

In the present series of studies we examined college students' understanding of the use of connectors by having students complete a rational cloze task in which the four previously mentioned connector types served as multiple choice alternatives. We wished to determine

whether the four types of logical connectors were differentially difficult for readers to understand. Our expectations were that sequential connectors would be more difficult than the other three types of connectors for all types of readers because sequentials generally require reference to the more global discourse context whereas the other three do not. The prediction of increased difficulty is based on the finding that comprehension difficulty increases when establishing coherence requires reference to more "distant" prior input (e.g. van Dijk & Kintsch, 1983). Among the other three connector types, all indicate some form of continued elaboration of previous information. However, they differ with regard to what they signal is the connection of new information to previous information, with causal and adversative connectors signalling more specific relations than additives. The latter indicate only that the next piece of information will be adding "in some way" to the previous information. In contrast, as noted previously, causal and adversative connectors respectively signal causal or logical contingency or contrast between old and new information in the clauses joined by the connectors. Predictions about the relative difficulty among these three connectors were not made.

We were also interested in the strategies that readers used to arrive at their choices and whether these were similar for native English and ESL readers, especially where differential levels of English language proficiency were present. In prior research, Bridge and Winograd (1982) found that good readers tended to rely on both within- and across-sentence information when explaining connector cloze completions whereas poor readers tended to use one or the other. However, MacLean & d'Anglejan found that both ESL and native English speakers relied on across-sentence information when performing rational cloze tasks. MacLean and d'Anglejan (1986) also reported that ESL readers used similar across-sentence strategies in their first and second languages. We pursued the strategy question somewhat differently than MacLean and d'Anglejan (1986) by focusing on whether response justifications reflected the differences among the connectors that are cited by text linguistics, discourse analysts, and ESL teachers. We collected retrospective verbal reports from students explaining their choices. Our predictions were that the native English speakers would be more sensitive to the differences

among the connectors and this would be reflected in their response justifications, as well as in the frequency of correct choices. On the other hand, because ESL students tend to be taught prescriptive rules for connector usage, their justifications for correct choices were also likely to be appropriate.

Three experiments are described in this report. The studies compared the performance of native English speakers and ESL students in several populations that vary in level of language proficiency in English. In the first experiment, we compared cloze task and verbal justification performance of monolingual, native English speakers and ESL students in a population of university students. Based on the findings from Experiment 1 of differential difficulty among the connector types, the purpose of Experiment 2 was to determine if monolingual, native English speakers' confidence in their answers also varied with connector type. Finally, in Experiment 3, a group of community college ESL students completed the rational cloze task, provided confidence ratings and gave verbal justifications for their responses.

EXPERIMENT 1: Effects of Connector Types on the Cloze Completions and Response Justifications of Native English and ESL Speakers.

The purpose of Experiment 1 was to compare the performance of native English and ESL university-level college students on a rational cloze task that required them to distinguish among four logical connectors in choosing the most appropriate intersentential connector. The rational cloze procedure was applied to passages characteristic of introductory-level textbooks used in university settings. Our general prediction was that ESL students would make fewer appropriate choices than native English speakers. We expected the differential difficulty of the four types of connectors to be similar in each group of students. Finally, based on previous research we expected that ESL and native English speakers would be similarly aware of prescriptive rules on the usage of the various connector types but that the ESL students would be less accurate identifying where in text the various rules applied.

Method

Subjects.

Participants were 16 monolingual, native English speakers and 20 ESL speakers. All students were recruited from undergraduate classes at a university in Southern California. The native English speakers were enrolled in Introductory Psychology and participated as part of the course requirements. The ESL students were enrolled in English-language classes specifically designated for nonnative speakers of English. Successful completion of these classes is a prerequisite to satisfying the university's General Education English requirement. ESL students who participated in this study were volunteers recruited from classes at three levels, but the majority (15 students) came from the class (English 1) one level below the university-required English class.[1] ESL students were paid $5 per hour for their participation.

Several demographic characteristics were assessed using a questionnaire filled out at the beginning of the experimental session. A summary of information most pertinent to the present study is provided in Table 1. The native English speakers were largely college freshmen and sophomores and all spoke English as the native language. The mean verbal Scholastic Aptitude Test (SAT) Score of 526.8 indicates that these students were representative of the entering freshmen classes at this university over the past several years. The ESL students were largely freshmen and sophomores. The native language of 70% of the ESL students was an Asian language (Chinese, Vietnamese, Japanese or Korean). The verbal SAT scores for the ESL speakers are typical for this population. Performance on the Test of English as a Foreign Language (TOEFL) is the language proficiency indicator typically used in making admissions decisions. The mean score of 564.7 is representative of students from non-English speaking countries who are admitted to the university.

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Insert Table 1 about here

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As an extremely rough indicator of background knowledge about the passage topics, the questionnaire asked students to indicate how many high school and how many college-level courses they had taken in domains related to the content of the passages (e.g., biology, oceanography, history, sociology, anthropology). Most of the students reported having taken 2 or 3 courses in these areas. Thus, there was little variability among the students and all could be regarded as relatively "low knowledge" in the domains discussed by the passages. The majors reported by the native English and ESL students indicated an interesting difference between groups. The majority of the ESL students were majoring in the natural sciences, including engineering. In contrast, half of the native English speakers were undecided about their choice of major, with only 18% indicating natural sciences.

Design and Materials

The design was a mixed factorial with one between-subjects factor (native English or ESL language group) and one within-subjects factor (connector type). There were four levels of connector type: Additive, Causal, Adversative, and Sequential. Each connector type was the correct response twice in each of 4 passages for a total of 8 observations per subject on each connector. In addition to examining the number correct, we asked subjects to explain their choices for two of the passages. Passages were presented in four different orders, according to a Latin-square design. Within each language group, each presentation order was used an equal number of times.

Passages. Four passages from college-level, introductory science and social science textbooks were modified to accommodate 2 instances of each of the connector types. The mean number of words per passage was 488, with the shortest being 427 words in length and the longest 537; the mean number of sentences was 32.75, with the shortest passage having 29 sentences and the longest 35. For 2 of the passages the Flesh grade level equivalent was 9 -10 and for 2 it was 11-12. The passages were about biological characteristics of life, anthropological approaches to the study of culture, oceanographic explorations in the nineteenth century, and the societal functions of marriage. For purposes of illustrating the task to

subjects, an additional, shorter passage (about the movie industry) was developed. It contained one instance of each connector type and was at grade level 7-8 on the Flesch scale.

Subjects' task was to read each passage and to choose an appropriate word to fill in each of the cloze slots (represented as blanks) that occurred throughout the passage. Each cloze slot occurred at the beginning of a sentence and four alternatives were provided. Each half of each passage contained four slots and each slot required a different connector type as the correct answer. A minimum of one complete sentence separated successive slots. The alternatives were instances of the four connector types; the correct response for each cloze slot was determined by the experimenters. That the experimenter-designated response was the best choice for the slot was verified by a panel of three independent judges, one of whom is an ESL specialist. The same connector type could not be the correct choice for two successive slots, and the sequence of connectors as correct choices was different in each half of the passage, as well as across passages. No one connector type appeared consistently in the same cloze slot across passages. The order of the alternatives was systematically varied so the correct choice occurred in each position (1, 2, 3, or 4) an equal number of times. The order of the distractors was also varied so instances of the same connector type did not always appear in the same position.

Our classification of connector types and the specific instances used as response options were taken from the functional classification scheme proposed by Celce-Murcia and Freeman (1983) and based on the earlier work of Halliday and Hasan (1976). For the additives we used simple additive instances (e.g., *in addition*) and exemplification instances (e..g., *for example*); for causals, we used instances that signal cause/reason (e.g., *as a result*) and effect/result (e.g., *thus*). For adversatives we used instances that signal that two ideas are in contrast or conflict (e.g., *however*) and instances that signal a reservation or restriction in the applicability of the preceding information (e.g., *despite*). Sequential connectors featured the largest variety of subtypes and we used instances that signalled enumeration of points chronologically (e.g., *second*) or temporally (e.g., *next*) as well as those that indicated summation of information (e.g., *in short*). Table 2 shows the specific instances that served as

the correct response for each connector type across the four passages. The number of times a specific instance served as distractor as well as as a correct response was equalized as much as possible. Where inequalities in the frequency of occurrence were necessary, we used those instances that occur more frequently in standard texts.

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Insert Table 2 about here

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The passages (including the practice passage) were arranged in a single "passage" booklet, and the alternatives for the slots for each passage were arranged in a separate "response" booklet. The order of the four passages was counterbalanced such that, across all subjects, each passage appeared in each position in the booklet an equal number of times. To avoid differential cueing of the various connectors, all punctuation usually associated with the use of the connectors (e.g., a comma) was omitted.

Procedure. Subjects were run individually in sessions lasting 1.5 to 2 hours. Each subject completed a background questionnaire at the start of the session. After filling out the questionnaire, each subject was instructed on how to coordinate the passage and response booklets and worked through the practice passage during which time they could ask questions about the task. For each blank, subjects circled the best word to complete the sentence from among the four alternative words that were provided in the response booklet. Subjects were told that all punctuation associated with the alternatives had been intentionally omitted, but that they could add any punctuation they felt was necessary to their response.

Following completion of the four passages, the experimenter re-presented the first two passages (excluding the practice passage) the subject had read. Subjects were told that we were interested in how they had decided on their answer and, in why they thought their answer was the best choice for the particular blank. For each blank, the students explained their reasons for selecting their alternative choices. This part of the session was audiotaped and later transcribed.

Scoring

Each subject received a score from 0 to 8, indicating the number of correct responses to the 8 cloze slots for each connector type. We determined the frequency with which each of the three distractor alternatives was selected incorrectly. For the incorrect responses we also examined the contingency relation between the correct connector and the type of distractor chosen. In the verbal justifications, students tended to describe the type of relationship that held between the items of information that were being connected. To score these responses, a set of 11 coding categories was developed. Descriptions of the categories were initially developed by the second author who used them in scoring 20% of the protocols. A second rater used the descriptions to score the same 20%. Interrater reliability was 70%. The two raters then discussed and revised the category descriptions (provided in Appendix A) and independently coded a new 20% sample. Interrater reliability for the second sample was above 90%. The second rater then scored all of the protocols. The categories reflect the distinctions among the connectors described in the introduction and each coding category was appropriate for only one of the connector types.

Results

Correct Responses

The number correct for each subject for each connector type was subjected to a multivariate, split-plot ANOVA in which language group was the between-subjects factor and connector type the within.[2] The means for each connector type and language group are provided in Table 3. As expected, the main effect for language group was significant, F (1, 33) = 15.28, $p < .001$, MS_{error} = 5.02: The native English speakers were correct more often (M = 6.34) than the ESL students (M = 4.88). In addition, there was a main effect for connector type, F (3, 32) = 3.27 p = .03. Five post hoc contrasts, using the Bonferroni procedure (alpha level = .01), were conducted. Additives and causals were correctly answered more often than were adversatives and sequentials, F (1, 34) = 8.46, p = .006, MS_{error} = 6.69. The other

four contrasts were not significant nor was the interaction between language group and connector type, F (3, 32) = 1.58.

Insert Table 3 about here

Distractor Choices

The correct response data indicate that the ESL speakers made more errors than the native English speakers - a mean of 12.2 per student (out of 32 possible) compared to 6.62. Regarding these errors, the following issues were of interest: (a) which connectors made the best distractors, i.e., were most frequently chosen, and (b) whether the distractors chosen by the two groups were similar. To investigate these issues, we computed the proportion of each subject's total errors that reflected each distractor option. The proportion data were subjected to an arcsine transformation and then submitted to a multivariate, split-plot ANOVA with language group as the between-subjects factor and connector type as the within. There was no main effect for language group, F (1, 34) = 3.04, p = .09. However, there was a main effect of connector type, F (3, 31) = 10.06, p < .001: Additives and causals were chosen significantly more often than adversatives and sequentials, F (1, 33) = 9.48, p = .004.

There was also a significant language group by connector type interaction, F (3, 31) = 4.69, p = .001. Table 4 gives the mean proportions for each distractor and language group. Examination of the means suggested that the interaction was due to differences in the magnitude of the differences among distractors. Accordingly, three difference scores were computed for each subject in each group and the differences between the distractors were tested for significance. The Dunn-Bonferroni procedure was used to control the Type I error rate (alpha = .017). Causals were chosen significantly more than adversatives by each group but the difference was larger in the native English speakers, t (32) = 2.83. The ESL speakers chose the adversatives and sequentials equally often but the native English speakers chose the sequentials more often than the adversatives, t (32) = 2.46. Although the means suggest that

the native English speakers chose causals more frequently than additives while the ESL speakers chose additives more than causals, the difference between the groups failed to reach conventional levels of significance, t (32) = 1.88.

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Insert Tables 4 & 5 here

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An additional analysis pursued potential dependency relations between the errors and the correct connectors. The presence of a strong dependency, reflected by a dominant distractor for a particular connector type, would suggest some type of systematic misunderstanding of the meaning and usage of that connector. The proportions shown in Table 5 reflect the number of times each of the distractor options was chosen relative to the total number of errors on each connector. These dependency matrices indicate a relatively strong relationship between additive cloze slots and causal distractors for both the native English and the ESL speakers (probability of choosing a causal if an error is made on an additive cloze slot = .76 and .60, respectively). For each of the other connector types, incorrect responses tended to be split between two distractor options. For example, both additive and sequential distractors were chosen for the causal cloze slots. On the adversative slots, errors were evenly split between additive and causal distractors. The native English and ESL students differed somewhat in their choices on the sequential cloze slots: When the native English speakers made errors on the sequentials they chose the additive and causal distractors equally often. When the ESL speakers made the wrong choice on the sequential slots, they had a greater tendency to select the additive connector (50%).

Both native English and ESL speakers were most frequently correct when additive or causal connectors were required by the text; they also chose these two types of connectors most often when they responded incorrectly, and there was some evidence of a dependency relationship between the additive cloze slots and the causal distractor. The higher correct and distractor choice rates for additives and causals suggests the possibility that subjects were

generally biased toward choosing additive and causal terms. We examined this by determining the rates of choosing each of the four connector types as responses, regardless of whether the response was correct or incorrect. Then we determined the percentage of choices that were indeed correct. These selection rate data are presented in Table 6.

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Insert Table 6 about here

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According to the design of the passages, each connector should have been selected 25% of the time. The data indicate that the native English and the ESL speakers selected the causals and the additives more frequently and the adversatives and sequentials less frequently than a "completely correct" response profile. However, the probability of being correct, given the choice of a particular connector, was higher for the adversatives and the sequentials than for the additives and causals. It appears that both native English and ESL students may have a more stringent set of constraints governing the appropriateness of adversative and sequential terms than those that govern additive and causals. It is also possible that adversative instances are less familiar (frequent) than the causal and additive instances.

Justifications for Choices

Justifications for Choices that were Correct. Table 7 indicates the distribution of correct-choice justifications over the coding categories.[3] The proportions were computed separately for each connector type, using the total number of justifications for the specific connector as the base. There are several interesting aspects of these data. First, the distribution of justifications for the ESL students is highly similar to that of the native English speakers: for each connector type, the proportional distributions over the coding categories for the connector reflect the same pattern. When there was a dominant response, as in the case of the causals, the adversatives, and the sequentials, the proportions for the ESL and the native English speakers were almost identical. Second, for the adversatives and the sequentials over 95% of the justifications were accounted for by connector-appropriate categories. The

proportion of connector-appropriate justifications was somewhat lower for the additive and causal connectors, although more than 75% were in connector-appropriate categories.

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Insert Tables 7 & 8 about here

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Justifications for Choices that were Incorrect. The distributions of the justifications for incorrect choices are shown in Table 8. The confusions among connectors that were reflected in the contingency analysis of the errors (Table 5) were generally reflected in the justification data.[4] When students were justifying incorrect responses that had been made to additive slots, the majority of the justifications were in categories appropriate to causal connectors. This is consistent with the data showing that causal distractors were the most frequently chosen for additive slots. The most frequent justifications for incorrect choices for causal slots were in categories appropriate for additive connectors, with the remaining responses distributed over the causal-appropriate, adversative-appropriate and miscellaneous categories. The additive and causal distributions for native English and ESL speakers were highly similar.

There were some differences between the language groups in the distributions of justifications for incorrect responses made to adversative and sequential slots. For adversative slots, the native English speakers used categories appropriate to the causal 56% of the time and categories appropriate to the additive 13% of the time. In contrast, the ESL students used causal- and additive-appropriate categories equally often (34% each). The native English speakers' justifications of incorrect choices for sequential slots tended to be in causal-appropriate categories most frequently and additive-appropriate or sequential-appropriate categories equally often (24% each). On the other hand, for incorrect sequentials the ESL students used additive-appropriate categories most frequently, causal-appropriate less often, and rarely used sequential-appropriate justifications.

The distractor dependency analysis and the justification data considered separately suggest that errors may be due to a "fuzzy" understanding of certain connectors. To more

precisely pursue the source(s) of difficulty on items that students answered incorrectly we examined the relation between the justification and the connector selected. Three relations are informative with respect to source(s) of difficulty and these are illustrated in Figure 1.[5] The first relation - incorrect alternative but a justification appropriate to the alternative chosen - indicates that the error is due to difficulty processing the information in the text: the student has selected the connector that matches the relation extracted from the text but it is not the logical relation actually called for by the text. For example, students' understanding of the text may have made them think that a causal connector was needed in an additive slot; students chose the causal and explained their choice using a causal-appropriate justification; Thus, they supplied the right connector for the wrong relation. This was the dominant pattern for both the native English speakers (63% of 56 opportunities) and the ESL speakers (65% of 122 opportunities).

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Insert Figure 1 about here

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The second type of relation between the connector selected and the justification - incorrect alternative but with a justification appropriate to the cloze slot - implies difficulty with the meaning of the connector terms: the student has extracted the logical relation called for by the text but does not choose the connector that conveys that relation. For example, the student explained the (incorrect) choice of a causal saying that what was needed in the text was an additive connector. This pattern did not account for many of the errors: 16% for the native English speakers and 6% for the ESL. The third relation reflects problems in processing the text and in matching connector terms with the inferred relation. In this case, the student selected an incorrect connector and provided a justification that was appropriate to neither the selected connector nor the cloze slot in the text. This pattern accounted for a moderate amount of the native English speakers' responses (21%) and for a somewhat higher percentage of the ESL students' responses (30%).

Thus, difficulty extracting the appropriate logical relation is implicated as an important source of student errors: inaccurate inferences about the appropriate logical relation between information contained in successive sentences in the text accounted for the vast majority (95%) of the ESL students' errors and 84% of the native English students' errors. The data also indicate that a simple "lack of knowledge" of the functions and meanings of various connector-type instances was not a primary reason for incorrect responses.

Discussion

The results indicate that native English speakers correctly completed more of the cloze slots than did the ESL students. For both groups, the pattern of difficulty among the connector types was similar: cloze slots requiring additive and causal connectors were more likely to be filled in correctly than were cloze slots requiring adversative or sequential slots. This pattern of differential difficulty partially confirmed our expectations. Although we had expected the sequentials to be the most difficult, we had not expected the adversatives to be as difficult as the sequentials. Justifications for correct responses were similar for the two language groups and reflected the distinctions among connectors that we had postulated.

When incorrect responses were made, differences, as well as similarities, emerged between the language groups and among the connectors. In general, when native English speakers were incorrect they completed the cloze slots with causal connectors whereas the general tendency for the ESL students was to choose additive connectors. When these choices were examined contingent on the correct response for the cloze slots, we found that when additives were the correct choice, both language groups had primarily chosen causals. Both groups showed similar choices when they incorrectly responded to causal and adversative cloze slots. However, the two groups differed on their incorrect choices for sequential cloze slots, with the ESL students primarily choosing additives while the native English students selected both causals and additives.

In both the ESL and native English speakers, there were tendencies toward overuse of the additive and causal terms. And although students were correct most frequently on additive

and causal cloze slots, when they did choose adversative and sequential instances, there was a high probability that these choices were correct. Taken together, these findings suggested the possibility that students' perceived confidence about the appropriate logical relationship and choice might be less when they chose additives and causals as compared to when they chose adversatives and sequentials. We pursued this issue in Experiment 2 with native English speakers by administering a confidence rating scale along with the forced-choice cloze task.

EXPERIMENT 2: Effects of Connector Types on Cloze Completions and Confidence Ratings of Native English Speakers

Experiment 2 tested the hypothesis that students would be more confident of adversative and sequential cloze slot completions than of additive and causal completions. This study also served as a replication of the basic findings of Experiment 1 with a new sample of native English speakers. The methods used were similar to those of Experiment 1, except that confidence ratings were made and no justification data were collected.

Method

Subjects

Thirty-two native English speaking undergraduates enrolled in an Introductory Psychology class at a university in Southern California participated in this study for class credit. The demographic data reported on the background questionnaire are summarized in Table 9. Freshmen and sophomores comprised this sample of native English speakers, mean age was equivalent to the native English group from Experiment 1, but the verbal SAT score was about 50 points higher. Subjects had taken about the same number of related courses as the students in Experiment 1, with only one student indicating no courses in any of the passage-related areas. A somewhat higher percentage of these students were majoring in the Social Sciences (43%) and only 28% were undecided. The percentage of students majoring in natural sciences and engineering was lower than that reported by the ESL sample from Experiment 1 but was comparable to the native English sample.

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Insert Table 9 about here

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Design, Materials and Procedure

The materials used in this study were identical to those used in Experiment 1 with the addition of a confidence scale that was printed on every page of the response booklet. This scale was printed in number line form and ranged from 1 (very low confidence) to 7 (very high confidence). Beneath each number was printed a word reflecting the degree of confidence represented by that number. The procedure was identical to that of Experiment 1 with three exceptions: 1) all subjects were run together in a single group session; 2) no interviews were conducted with these subjects; and 3) after deciding which alternative was correct for each slot, subjects were instructed to rate the confidence they had in their choice by circling a number from 1 to 7 on the scale printed below the alternatives.

The design was a single factor within-subjects design in which connector type was a four-level factor.

Results

Correct Responses.

As in Experiment 1, the number of correct responses for each type of connector was computed for each subject. The results of a one-way, multivariate, repeated measures ANOVA indicated a significant effect for connector type, $F(3, 29) = 8.86$, $p < .001$. Four post hoc contrasts of the means shown in Table 10 were computed, using the Bonferroni procedure (alpha = .0125). As in Experiment 1, additives and causals were correctly answered more frequently than were adversatives and sequentials, $F(1, 31) = 13.4$, $p < .001$, $MS_{error} = 6.8$. Causals were correct more frequently than additives, $F(1, 31) = 8.02$, $p = .008$, $MS_{error} = 2.43$. The difference between adversatives and sequentials was not significant, $F(1, 31) = 1.37$. Also shown in Table 10 are students' confidence ratings for those items that were correct. A multivariate one-way ANOVA on the confidence ratings indicated a significant effect of

connector type, F (3, 29) = 8.8, $p < .001$. Post hoc comparisons of the additive and causal ratings with the adversative and sequential ratings confirmed our prediction: Confidence ratings were higher for correctly chosen adversatives and sequentials than for additives and causals, F (1, 31) = 23.75, $p < .001$, $MS_{error} = .771$.

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Insert Tables 10 & 11 about here

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Distractor Choices.

As in Experiment 1, we computed the distribution of each subject's total errors over the distractor alternatives. These proportions were transformed using the arcsine transformation and submitted to a one-way, multivariate, ANOVA. There was a significant effect of connector type, F (3, 29) = 14.65, $p < .001$. The mean proportions and the transformed values are provided in Table 11. Four post hoc comparisons (alpha = .0125) indicated that additives and causals were chosen as distractors more frequently than adversatives and sequentials, F (1, 31) = 44.85, $p < .001$, $MS_{error} = .772$. Causal distractors were chosen more frequently than additives, F (1, 31) = 7.57, $p = .01$, $MS_{error} = .605$. Adversative and sequential distractors were chosen equally often. Confidence ratings on the incorrect choices did not significantly differ across the four connector types, F (3, 60) = 2.16, $p = .1$.

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Insert Tables 11, 12 and 13 about here

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The results of analyzing the dependency between the correct connector types for the cloze slots and the type of distractor selected when errors were made are given in Table 12. The pattern replicates the pattern observed in Experiment 1. The causal connector was the dominant distractor for additive cloze slots, and the distributions for the adversative and sequential cloze slots were virtually identical to those given in Table 5. The one difference between the results of the two experiments is that more adversative distractors were chosen in causal slots by the students in the second study.

We examined the selection rate data for evidence of a choice bias toward additive and causal distractors and the selection rate data are shown in Table 13. The percentages indicate a bias toward causals in that 32% of choices were causals; however, only 66% of those choices were correct. There was less of a bias toward additives than in Experiment 1. Adversatives and sequentials were chosen least frequently but had the higher percent correct rates. Confidence ratings for correct responses were highest for the less frequently chosen connector types.

Discussion

The results of Experiment 2 replicated the findings of Experiment 1 and extended them by showing that students were more confident of cloze completions for adversative and sequential connectors. Adversative and sequential connectors appear to have more restricted and perhaps clearer usage conditions than do additives and causals. Causals and additive terms, such as *and* and *so* may be more frequent in everyday language and their usage may not always literally connote a highly restricted meaning compared to adversatives and sequentials; as a result, some of their more specific meanings may become "diluted" in text more so than adversatives and sequential. Students may choose additives and causals because they are more familiar in everyday speech, not because they are certain about their appropriateness in the contexts of written text. Hence, even when their choices are correct, students' confidence in additive and causal completions is weaker than their confidence in less frequently chosen adversative and sequential connectors.

These data provide support for the interpretation tnat although adversative logical relations and sequential temporal relations are less often constructed by students, when they are constructed students are confident of the accuracy of their inferences. There is significantly more doubt when causals and additives are selected for use in a text. Experiment 3 pursued these issues with ESL students at generally lower levels of English language competency than the individuals who participated in Experiment 1. Because of this, we also used a new sample of texts appropriate to this population and a somewhat different set of connector terms.

EXPERIMENT 3: Effects of Connector Type on Cloze Completions, Confidence Ratings and Response Justifications of ESL Speakers

The purpose of Experiment 3 was to examine whether ESL students' confidence in their cloze completions varied with the type of connector. In addition, we were interested in testing the replicability of the ESL results from Experiment 1. Due to constraints on the ESL population in our locale, the sample for Experiment 3 was drawn from a local two-year, community college rather than from the university. Because this population is generally at lower levels of English language proficiency than the university population, we developed a new set of passages based on texts at the level of the students' proficiency in English. Thus, Experiment 3 was a replication/extension of the basic findings of Experiments 1 and 2 to both a new subject population and different materials. Data were collected on the cloze completion, the confidence rating and the response justification tasks.

Method

Subjects

Participants were 35 ESL students enrolled in the advanced-level ESL English course at a local community college. Nineteen of the students were enrolled in a course that met during the day and 16 attended a night class. All students in the class participated in the paper and pencil part of the task and it was conducted during class time. Following the group session, 8 students from the day class and each of the night class students were individually interviewed for purposes of explaining their response choices on the first two passages that they had read.

The ESL students in Experiment 3 were more heterogeneous than the ESL students who participated in Experiment 1. As is evident from the data in Table 14, the subjects in the present study were older and reflected a greater age range. They had taken fewer related courses and the level of English language skills ($\underline{M}$ = 5.3 grade level equivalent) was lower than for the ESL students in Experiment 1, who were reading at levels sufficient to enter the university. Experience in courses related to the passage topics was similar to that reported by students in the other studies, a mean of 2.34 but only 15 students had taken such courses. The

other 20 did not report any courses in high school or community college related to the passage content. Most of the students had had 3 or 4 courses at the community college prior to the time of participation in the study.

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Insert Table 14 about here

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Design and Materials

The design was a mixed factorial in which class (day or evening) was a between-subjects factor and connector type (four levels) was the within-subjects factor. Dependent measures were derived from the cloze completion responses, the confidence rating task and the justification data. Due to the generally lower level of English skill in this population of ESL students as compared to the university students of Experiment 1, new passages were developed. The same constraints on the occurrence of blanks and distribution of response alternatives described for Experiment 1 and 2 were followed in constructing the passages used in Experiment 3.

Passages. The four passages were modified versions of texts drawn from textbooks that had been used in the past by the ESL program at the community college but not by the particular students who participated in the study. We selected passages that dealt with fields in the social and natural sciences. Specifically, the following topics were discussed: life styles during the Paleolithic Age, emotions that cause laughter, the natural resources in Siberia, and the mystery of the Bermuda triangle. After modification to accommodate the connectors, the mean number of words per passage was 518, with the shortest 507 words in length and the longest 539; mean number of sentences per passage was 32.25, with the shortest having 28 sentences and the longest 38. For 3 of the passages, the Flesch grade level equivalent was 9-10 and for 1 it was 7-8.

The instances of the four types of connectors used in the new passages are given in Table 15. As with the four passages used in the Experiments 1 and 2, a range of instances were used

for each connector type and we equalized the frequency of occurrence of each instance as much as possible.

Insert Table 15 about here

A passage booklet and accompanying response booklet were created for each subject. The passages were presented in four different orders to counterbalance position effects for the experimental passages. The practice passage, presented first, was the same one used in Experiments 1 and 2. As in Experiment 2, each page of the response booklet contained the four alternative choices for a particular cloze slot as well as a confidence rating scale. The same constraints described for Experiments 1 and 2 on the ordering of the response alternatives were followed in this experiment.

Procedure

The subjects enrolled in the day class completed the passage and response booklets over a series of 4 class sessions, each session lasting for 55 minutes. The subjects enrolled in the evening class completed their booklets over a series of 2 class sessions each approximately 2 hours in duration. The procedure involving the booklets was identical to the one used in Experiment 2. After completing the booklets, a sample of 8 students from the day class were seen in individual sessions and asked to explain their response choices for the first two passages. Subjects were systematically selected so that a discussion of each passage occurred an equal number of times. All subjects enrolled in the evening class were interviewed. The interviewing process for subjects in both classes began once all subjects in the class had completed the booklets, and spanned a period of several days because of the limited time available for individual sessions.

Results

Correct Responses

The mean probability of correctly selecting each type of connector was computed for each student.[6] A split-plot, multivariate ANOVA revealed no main effect (F (1, 33) = 2.93, p > .05) nor interaction (F < 1) involving the class variable. However, consistent with Experiments 1 and 2, there was a main effect of connector type, F (3, 31) = 13.76, p <. 001. Five post hoc comparisons were computed using the means shown in Table 16 and the Bonferroni procedure was used to control the Type I error rate (alpha = .01). Additives and causals were correctly chosen more frequently than adversatives and sequentials, F (1, 33) = 36.27, p < .001, MS_{error} = .075. Additives and causals were not significantly different, F (1, 33) = 3.47; nor were adversatives and sequentials, F (1, 33) = 3.45. This pattern replicates the results obtained in Experiments 1 and 2: Responses for additive and causal slots were more often correct than were those for adversative and sequential slots.

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Insert Table 16 about here

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In contrast to the findings of Experiment 2, the ANOVA of the confidence rating data failed to reveal any significant differences due to connector type, F (3,93) = 2.19, p = .09, MS_{error} = .24. Thus, the ESL students were no more confident of their adversative or sequential choices than they were of their additive and causal choices. Furthermore, their confidence ratings for their correct answers were about 1 scale value below the ratings of the native English speakers' confidence in their correct answers.

Distractor Choices

To examine whether there were differences among the connectors in the likelihood of being selected as a distractor, we computed the proportion of each subject's total errors associated with each distractor alternatives. These proportions were then transformed using the arcsine transformation and submitted to a multivariate, split-plot ANOVA in which class and

connector type were factors. As in the analysis of the correct responses, there was no effect of class, F (1, 33) = 3.51, p = .07. There was, however, a significant effect of connector type, F (3, 31) = 20.77, p < .001. The means are shown in Table 17. Five post hoc comparisons, using the Bonferroni procedure (alpha level = .01), were conducted. Additive and causal distractors were selected more frequently than adversative and sequential distractors, F (1, 33) = 51.77, p < .001, MS_{error} = .381. Causal distractors were selected significantly more often than additives, F (1, 33) = 13.23, p < .001, MS_{error} = .24. The probabilities of choosing adversative and sequential distractors were not significantly different from one another; nor were the probabilities of choosing additive and adversative distractors. The distractor choice data replicate the findings for the native English speakers in Experiments 1 and 2 in that causals were the most frequently chosen distractor. For the ESL students in Experiment 1 there was a tendency to choose the additives and causals most often; thus there was a minor difference between the two samples.

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Insert Table 17 about here

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ANOVA on the confidence ratings for the incorrect cloze completions revealed a significant effect of connector type, F (3, 29) = 3.96, p < .01. Post hoc contrasts indicated that confidence was higher for adversative distractors than for sequential distractors, F (1, 31) = 11.24, p = .002. Examination of the patterns of the means shown in Tables 16 and 17 suggested that there was a potentially interesting interaction between connector type and ratings for correct compared to incorrect choices. The ANOVA on these data indicated higher confidence when the correct alternative was chosen (M = 4.93) than when a distractor was chosen (M = 4.57), F (1, 28) = 14.29, p = .01. There was also a significant connector type by correctness interaction, F (3, 26) = 3.64, p = .02. The interaction was pursued with three posthoc contrasts (alpha level = .017). The significant contrasts indicated (1) that the difference between ratings of correct and incorrect responses was larger for sequential connectors than it

was for the other three connector types, F (1, 28) = 8.63, p = .007, MS_{error} = 8.57; and (2) that correct selections of sequentials received higher confidence ratings that when sequential distractors were chosen, F (1, 28) = 17.33, p < .001, MS_{error} = .971.

The results of Experiments 1 and 2 suggested that both native English and ESL students often selected causal connectors when additives were most appropriate. In the present sample of ESL students, the dependency relation analysis indicated a much weaker relationship. As the data in Table 18 indicate, 50% of the distractor selections for additives were causals but adversatives were selected in almost 40% of the cases. In addition, additive and adversative distractors were the most frequent distractors selected when errors were made on causal slots; finally, causals were the most frequently selected distractor for adversative and sequential slots. It appears that these ESL students who were at lower levels of language proficiency had a strong tendency to overattribute causality.

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Insert Table 18 & 19 about here

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That there was a general bias toward selecting causal connectors is further supported by the analysis of the connectors selected by the students. The data are provided in Table 19. First, 34% of the choices were causals, reflecting the tendency to choose causal alternatives. However, the likelihood that these choices would be correct was relatively low, 42%. Sequentials were least often chosen but had the highest likelihood of being correct. Additives were given the highest confidence ratings, in contrast to the pattern manifest by the native English speakers in Experiment 2. Thus, although the adversative and sequential alternatives were selected least often, they did not manifest the pattern of proportion correct and confidence ratings that prevailed in Experiment 2. Nor did the present sample of ESL students manifest the pattern shown by the ESL students in Experiment 1, wherein adversative and sequential alternatives were selected least frequently but were most frequently correct. It is possible that these ESL students who are at less sophisticated levels of English language training did not make

use of the greater degree of constraint governing the use of adversative and sequential connectors. The verbal justifications were pursued to enlighten the criteria that these students were, in fact, using.

Justifications of Responses

Justifications for Correct Responses. Table 20 provides the proportion of responses in each of the justification categories for each of the connectors.[7] Several trends are important. First, the majority of the justifications for each of the connectors were consistent with definitions and taxonomies of logical connectors, .i. e., 60% or more of the responses were in connector-appropriate categories. Furthermore, the dominant responses within each category were consistent with the dominant responses obtained from the native English and ESL four-year college students in Experiment 1. Justifications for additive slots were divided between example and elaboration. The dominant justification for causal slots was the existence of a cause-effect relation; the dominant justification for adversative slots indicated that comparison, contrast, or unexpected information was present. For the sequential slots, justifications involving new or next points or temporal relations were given. There was some difference between the pattern on the sequentials in this study and the patterns in Experiment 1; however, in designing the texts for Experiment 3 we purposely tried to use connectors that indicated temporal relations or "next" points. Thus, differences in the sequential justification data between Experiments 1 and 3 are undoubtedly due to the specific passages and connectors we included in the materials.

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Insert Table 20 about here

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There was one difference between Experiments 1 and 3 that was probably not due to the specific passages: Approximately 37% of the justifications for correct responses were in the Miscellaneous category and the majority of these were choice by exclusion, i.e., "The others didn't fit." The higher frequency of the miscellaneous category, especially making a choice by

eliminating the other options, suggests that the community college students may be operating with a greater degree of implicit or tacit knowledge about these connectors than are the university students.

Justifications for the incorrect responses. As with the justifications for correct responses, about 30% of the justifications of incorrect responses were in the miscellaneous category, with no difference between connectors in this trend. Consistent with the results of Experiment 1, the proportion of justifications for choices that were incorrect generally reflected the dependency relations that were reflected in Table 16. For example, 36% of the 44 justifications for incorrect causal-slot responses were additive-appropriate reasons and 18% were adversative-appropriate. For adversative slots, 27% were additive-appropriate and 27% were causal-appropriate categories. For incorrectly completed sequential slots, causal-appropriate explanations were provided 41% of the time. The additive slots were the only ones were subjects showed more than a slight tendency to use connector-appropriate connectors: 23% of the justifications for incorrect responses were additive-appropriate.

The justification data were used in conjunction with the completion data to examine the source(s) of difficulty for these students. Of the three relations discussed in the context of Experiment 1 and illustrated in Figure 1, we found two of them to be equally likely in the data of the ESL community college students. For 48% of the justifications for incorrect responses, students used a justification appropriate to the distractor they had selected (branch 1 in Figure 1). This pattern implies difficulty understanding the relation called for by the text. An additional 45% of the justifications for incorrect responses used a justification that was inappropriate given the slot in the text and did not fit the distractor selected (branch 3 in Figure 1). This pattern implies difficulties both in processing the relations in the text and in understanding the meanings of specific connector terms in context. Justifications that were inappropriate to the choice but appropriate to the slot were relatively rare (6%) and indicated that knowledge of the specific connector words was not the major source of difficulty. Thus, the

major problem seemed to be in processing logical relations in context and recognizing when the specific types of logical connectors were needed.

Discussion

The patterns of results in this study were generally consistent with our predictions and the results of those of Experiments 1 and 2. Cloze completion responses were more frequently correct for additive and causal slots than for adversative and sequential slots and justifications for the correct responses reflected the appropriate connector functions. However, contrary to expectations, the ESL students' confidence ratings for correct choices were equivalent to one another. When they were incorrect, ESL students most frequently chose causal distractors, although their confidence in these choices was not terribly high. The confidence rating data for the incorrect choices was unanticipated: students were more confident of wrong answers when they had chosen adversatives and additives than when they had chosen causals and sequentials. Finally, the dependency relations between the correct cloze completion and the type of connector incorrectly selected, in conjunction with the explanations of the incorrect choices, suggest that in this sample, the ESL students had a less precise understanding of the differences in meaning between frequently used causal expressions, such as *thus*, *so*, and *hence* and often confuse them with simpler additive or sequential indicators.

GENERAL DISCUSSION

In each of the three studies there was a consistent effect of connector type: when cloze slots required additive or causal completion terms, students were more likely to be correct than when adversative or sequential terms were needed. We had predicted that sequentials would be difficult because (1) there are a greater number of sequential subtypes and (2) correctly selecting one often requires a reference to the global passage rather than to the local clause or sentence context. We were somewhat surprised that the adversative tended to be as difficult as the sequential. We suggest three plausible explanations of performance on adversatives. The specific instances of the adversative may have lower frequency of use than the instances of additives and causals. Second, performance on the adversative may be affected by the existence

of a reader consistency bias. That is, readers may be operating with a default assumption that favors interpreting successive sentences as elaborating on the old material rather than by contradicting it or restricting its scope. Finally, recognition of an adversative relation may require a more complex backward search to prior content than the causal or the additive.

The effect of linguistic proficiency on correct performance was consistent with our general expectations. ESL speakers were able to correctly complete fewer cloze slots than native English speakers; community college ESL speakers performed at lower levels than university ESL speakers. However, it is important that the connector type pattern was generally consistent across groups.

That there was a response bias toward the additive and causal instances was illustrated in two of the measures. First, causal and additive connectors were the most frequently chosen distractors. Furthermore, the student selection rate data showed a strong tendency to choose causals and additives. The selection rate analysis also showed that adversative and sequentials were more likely to be correct when they were selected, and students had the highest degrees of confidence in these, although this effect was not as strong among the least English proficient.

Analyses of the incorrect choices revealed some interesting information regarding intersentential reasoning and inference making. Causal distractors were particularly likely when students failed to choose the correct additive alternative. Justifications for these errors indicated that students had inferred a causal relation where an additive had been intended. The tendency to incorrectly choose a causal was present but at attenuated levels for the adversative and sequential slots. The strongest trend toward choosing the causal was present in the data of the community college ESL students.

The patterns associated with incorrect responding may reflect two influences. Readers may be using the causal in an effort to create relatively tight connections among units of information. Alternatively, conversational English may create a "sloppy" meaning for causal connectors such as *so, thus,* and *because.* That is, these terms may be used in situations where a relationship other than cause-effect is being discussed. They may serve as "psuedo bridges"

rather than as true causals. As a result, greatest overuse of the causal would be expected for those students whose dominant experiences with English have been in informal, conversational contexts. Similar confusions in understanding the causal have been reported among children acquiring English as a first language (e.g., Corrigan, 1975). Content domain study demands more precision in the meaning of the language we use; connectors are no exception. Thus, as students engage in more interaction with formal text, they are forced to refine their understandings of these terms and the usage constraints that govern them.

The relationship between incorrect responses and their justifications indicated that errors were predominantly due to incorrect inferences about the appropriate logical relation and/or an inability to find the connector that expressed that relation in that context. When students had inferred the appropriate relation between sentences, they rearely erred in choosing the correct connector.

Our results indicate that for native English speakers as well as for ESL speakers who have attained levels of English proficiency equivalent to about the fifth grade, there are consistent differences among connector types. The correct choice justification data provide support for the theoretically-based taxonomic distinctions among connector types. In processing text, readers appear to assume that local coherence is based on a relatively generalized relation of expanding on the topic introduced by the previous sentence. The boundaries between a clear elaborative relation as compared to a bonafide cause-effect relation appear to be somewhat ill-defined and there is a tendency to overattribute the cause-effect relation. Logical relations that indicate contradiction or contrast between succesive sentences in text are more difficult for students to identify. When they do select an adversative connector there is a very high probability that it is correct.

Sequential connectors proved to be the most difficult. As suggested in the introduction the reason for the greater difficulty of this type of connector may be that it requires the use of more than local discourse context. Many of the sequential connectors used in the present studies require that the student keep track of the more global discourse organization. Furthermore,

sequentials, moreso than the other types of connectors, are often used to signal the general organization of discourse (cf. Lorch, in press) and a focus only on the local context does not provide sufficient information to adequately respond. Sequentials often mark the sentence they introduce as a preview or review of text information. This discourse function does signify a logical relation between the information so marked and the remainder of the text but it does not make clear the specific logical relation between the information in the sentence and the information in the just-prior sentence. When students answered these incorrectly their distractor choices seemed to reflect confusion over the precise nature of the logical relation: the additive, causal, and adversative alternatives were all chosen with some frequency.

A major source of difficulty for students doing this task was inferring the appropriate relation between successive sentences. For informational texts such as these, designed with the explicit purpose of communicating new information to students, it seems particularly important to use logical connectors, especially when contrastive points are being made. It is also clear that in content domains where it is important for students to clearly distinguish between psuedo and true cause-effect relations, explicit connectors in the text will facilitate accurate understanding. We also want to emphasize that differences in performance between native English and ESL students were largely in overall levels of performance and were not primarily associated with differential patterns among the connectors. General content-domain comprehension skills, rather than specific connector skills, are therefore implicated as the locus of the language group differences. Once ESL students have grasped the basic meaning and functions of instances of specific connectors, further drills on isolated use of connectors are not likely to lead to improved performance on connectors in natural text contexts. Rather, improving ESL proficiency at this level seems to require instruction that fosters understanding logical relationships between sentences and how connectors signal such relations when those sentences occur in meaningful, content-domain contexts.

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Appendix A

Categories used for scoring verbal justification data[a]

Connector: Additive

1. Information gives example of concept.

Second sentence states an example or particular instance of a concept or issue stated in the first sentence. (e.g., "The second sentence is an example of how it interferes").

2. Information elaborates prior information.

The second sentence elaborates on the content of the first sentence by stating additional related information. The information in the second sentence might be described as providing additional consistent information to the point stated in the first sentence. Also, the information in the second sentence might be described as being supportive of or strengthening the information in the first sentence. More specifically, subjects might say things such as "the second sentence explains more or tells more about the first sentence, or "This sentence supports the first sentence.

Connector: Adversative

3b. Comparison or contrast with information in the prior sentence; unexpected information.

The second sentence states a comparison, or something contrasting, opposite, or contradictory relative to the first sentence. Subjects might also refer to the content of the second sentence as "something unexpected". **This is not a new point** (such as in Rule 7). Instead, the content of the second sentence is merely different relative to the sentence before it....rather than part of a broader superordinate concept.

3a. Restriction of scope.

The second sentence is described as restricting the scope of the previous (first) sentence. This might be described as "limiting the boundaries of ..." or "putting a restriction on.." the content of the first sentence.

Connector: Causal

4. Cause - effect relationship between the two sentences.

The second sentence is a result, effect, or consequence of something that was "set up" in the first sentence. The important thing here is that the subject is stating that there is a **cause and effect** relationship going on between the first and second sentences. How the subject states this can take a variety of forms: First of all, the subject might use one of the three underlined words above; in addition, he/she might also use the word "because" in referring to the relationship between the two sentences as one of cause and effect (e.g., "Because of the hard water, she couldn't wash her hair"). A subject might also refer to the content of the second sentence as a conclusion (in a different way from Justification #6). This is a conclusion about cause and effect (typically regarding something stated only 1 or 2 sentences back). Be careful when subjects use the word "why". They might use "why" to refer to an explanation about the previous sentence (in that case, use Justification #11). Or they might use "why" to explain a cause and effect situation (and if so, then use the present category). Whatever words the subject uses, what is important about the present justification is that subjects state that their choice of connecting words was because of a **cause and effect** situation.

5. Consistent but baguely staed logical relationship.

This justification should be used when the subject says that some sort of consistent, logical relationship exists between the first and second sentences, but **is not explicit (i.e., is vague) about the nature of that relationship** Usually in this case, subjects say something like "the second sentence "follows"

from the first sentence". They might also say something like "the first sentence makes you expect what is stated in the second sentence"; or "the two sentences are just "connected together". The subject might also use the word "why" in their justification. In such a case, he\she might say something like "The second sentence tells why the first sentence was stated" or something equally as vague. The critical feature for this category is that the subject is indicated that the two sentences are logically related, although s/he is not stating what type of relationship exists. If the subject explicitly mentions a sequential or causal relation in their justification, then score that response as a #9 or #4, respectively.

4&6. Conclusion about a cause-effect relationship that was developed over several sentences.

The second sentence states **a conclusion about a cause and effect relationship.** Uusally, the cause and effect situation is expressed over several (prior) sentences. The connector introduces the final sentence in the cause and effect chain. A subject might say something like "The second sentence is concluding why a (previous event stated earlier in the passage) happened".

Connector: Sequential

7. Introduces new or next point.

The second sentence is the first, second, third, final, or new aspect of a multi-component concept. Subject will typically make reference to **some other part** of the passage which indicates the superordinate concept and/or other components that are also listed. Responses can be classified according to this justification if the subject says that the word signaled a new point (or a numbered or final point).

9. Temporal relation

The second sentence states or describes a second event that occurs after a previous event in the first sentence. Typically, a subject says that the relationship between the two sentences is one of **"first this happens, then this other thing happens"**. The second sentence states an event that is temporally distinct from an event stated in the first sentence. If the subject states that a causal relationship exists between the 2 events use Justification #4 If they mention that the two events are part of a single multicomponent concept , use justification #7 If they indicate the existence of a vague logical relationship between the events, use justification 5.

6,8, &11. Sums up prior or previews subsequent information.

There were several categories under this general heading.

6. The second sentence is summing up previous content, or making a conclusion about previous content. This content might be an entire passage ("This is concluding or summarizing what the passage was about"), or it might be several sentences (This is summarizing what was said in the above several sentences") Be careful here **not** to include those responses that are making a conclusion that pertains to a cause and effect relationship involving the first and second sentences - use justification 4 for this type of response. This kind of conclusion involves a larger body of text. i.e., it is a more **general** conclusion. Subjects might also say that this is a good word choice because it comes near the end of a text. Remember also, that this justification doesn't pertain to introducing a final or concluding point.

8. The second sentence is **summing up what's to come** later on in the passage. This kind of situation can also exist when the subject lists a **series** of components or issues that will be discussed later on in the passage.

11.The second sentence is a short explanation or summary of what was said in the prior (first) sentence. A subject might state that the second sentence described , defined, or summarized what just was said.

10. Miscellaneous

If a response cannot be categorized as adhering to one of the above itemized justifications, then it is classified as miscellaneous. Included in this category are the following:

a. Choice by exclusion: "None of the other three (alternatives) worked";

b. Guessing: "I just guessed at this one";

c. Restating or paraphrasing the text

d. Metacognitive or affective statements: "It was easy to understand...", or "It made me confused."

[a] The numbering refers to the original categories and is preserved here for archival purposes only.

Footnotes

1. There are three levels of ESL classes Linguistics 1, Linguistics 2, and English 1, however class instructors report that the variability within the class is often greater than the variability between classes. Following successful completion of English 1, students take the English composition course required of all freshmen. Four students came from Linguistics 2, and one from Linguistics 1. There were three additional students (from Linguistics 1) who began but did not complete the task because of their inability to deal with the level of English required by the study.

2. No ANOVA was done to examine passage effects because each subject provided only a score of 0, 1, or 2 for each connector type within a passage. We did however compute the number correct on each connector type for each passage. These totals indicated relatively equivalent performance across passages for the additive, adversative, and causal connectors. For the sequential connectors, two of the passages produced twice as many correct responses as in the other two passages for both native English and ESL speakers.

3. There was some concern that the verbal justification procedure would unfairly discriminate against the ESL speakers in terms of the information they could provide. This concern seems unwarranted because only 3% of the ESL students' responses were classified in the Miscellaneous category; 3% of the native English speakers' responses were also in the Miscellaneous category.

4. Students were not told whether the response they were attempting to justify was correct or incorrect. Some students did change their original response during the justification phase but the overall incidence was low: 4 for the native English speakers (3 changed from an incorrect to a correct and 1 from an incorrect to a different incorrect choice) and 23 for the ESL. About half of the ESL changes were from an incorrect initial choice to a correct final choice; 30% went from correct initial to incorrect final choices; and approximately 20% were changes from one incorrect response to another. For purposes of analysis of the number correct and distractor choices we used the "final" answer.

5. Data are not reported separately for each connector because the trends for each connector type were similar.

6. Probability correct was analyzed because of an experimenter error in constructing the materials - there were only 7 usable sequential slots for the day class. The error was corrected in the materials used with the evening class.

7. The were a total of 44 response changes during the justification phase. Half of these were changes from an incorrect response to a correct response; 13% were from a correct response to an incorrect one; and 37% involved changing among incorrect responses.

Table 1

Characteristics of the Students in Experiment 1[a]

Characteristic		Native English Speakers	ESL Speakers
Age	Mean	18.75	20.3
	Range	18-20	18-30
Age at which schooling	Mean	- -	11.63
in English began	Range	- -	4 - 26
Scholastic Aptitude Test (V)[b]	Mean	526.8	338.3
	Range	450 - 600	210 - 450
Social Science Courses	Mean	2.78	3.1
in High School or College	Range	0 - 12	0 - 15
Major Field of Study			
Social Science		31%	30%
Natural Science, including Engineering		18%	60%
Undecided		50%	5%
Native Language			
English		100%	0%
Spanish			5%
European (except Spanish)			25%
Asian			70%

(table continues)

Table 1 (cont'd)

[a] All data are self-reported. We did not have access to official student records.

[b] All 16 Native English speakers reported Verbal SAT scores; only 12 ESL speakers reported Verbal SAT scores. The mean SAT score for freshmen at this university has fluctuated around 500 for the past several years. An additional 7 ESL students reported scores on the Test of English as a Foreign Language (TOEFL) and 2 students reported both SAT and TOEFL scores. The mean TOEFL was 564.7, with scores ranging from 510 to 630. The mean TOEFL score is representative of that reflected in the nonnative English speaking undergraduate population at this university.

Table 2

Instances of Connectors and Frequency of Use as Correct Responses for the Passages used in Experiments 1 and 2

Additive		Adversative		Causal		Sequential	
in addition	2	nevertheless	2	thus	2	briefly	1
for example	1	but	3	consequently	1	first	2
for instance	1	however	3	as a result	1	finally	2
in particular	1			as a consequence	1	in short	1
moreover	1			so	1	second	1
in fact	1			therefore	2	third	1
indeed	1						

Table 3

Mean Number Correct on each Type of Connector in Experiment 1[a]

	Language Group		
	Native English	ESL	Overall Connector
Connector	(n= 16)	(n = 20)	Means (n = 36)
Additive	6.44	5.7	6.03
Causal	6.56	5.0	5.69
Adversative	6.19	4.35	5.17
Sequential	6.19	4.45	5.22
Overall Group Means	6.34	4.88	

[a]The overall means have been weighted to reflect the unequal sample sizes. The maximum number correct was 8.

Table 4

Distractor selections in Experiment 1[a]

	Language Group	
	Native English	ESL
	(n= 16)	(n = 20)
Mean errors[b]	6.62	12.20
Distractor Selected		
Additive	.29	.39
Causal	.41	.31
Adversative	.05	.14
Sequential	.16	.13

[a]The Anova was done on arcsine transforms of the proportion of incorrect responses for which each type of connector was selected. The means of the transformed measures were as follows. For the native English speakers: additive = 1.1; causal = 1.38; adversative = .44; sequential = .76. For the ESL speakers: additive = 1.37; adversative = .73; causal = 1.16; sequential = .7.

[b]The maximum number of errors was 32 (8 for each of 4 connectors).

Table 5

The Proportion of Errors on each Connector Type Accounted for by each of the Distractor Options for Experiment 1.[a]

	Distractor Options			
Correct Connector	Additive	Causal	Adversative	Sequential
Native English Speakers				
Additive	- - -	.76	.08	.16
Causal	.43	- - -	.09	.47
Adversative	.40	.43	- - -	.17
Sequential	.38	.41	.21	- - -
ESL Speakers				
Additive	- - -	.60	.24	.15
Causal	.47	- - -	.15	.38
Adversative	.49	.40	- - -	.11
Sequential	.50	.29	.21	- - -

[a]The proportions are based on the total number of errors for each connector type. For the Native English speakers the number of errors were the following: On additive slots, 25; on causal, 23; on adversative, 30; on the sequential slots, 29. For the ESL speakers the number of errors were as follows: additive , 46; causal , 60; adversative , 72; and sequential , 70.

Table 6

Student Selection Rate Distributions for Experiment 1

Connector	Percentage of Selections[a]		Percentage of Selections Scored as Correct	
	Native English	ESL	Native English	ESL
Additives	27	33	76	54
Causals	29	28	70	56
Adversative	21	19	91	71
Sequential	23	20	83	70

[a]Total number of selections for the Native English students was 512 and the total for the ESL students was 640.

Table 7

Proportions of Justifications in each Category for Correct Responses in Experiment 1[a]

	Language Group	
Connector and Justification Category[a]	Native English	ESL
Additives - Total number of correct responses	46	55
Information gives example of concept	.54	.40
Information elaborates prior information	.24	.42
Inappropriate justification	.17	.15
Causals - Total number of correct responses	51	46
Cause - effect relationship between the two sentences	.71	.67
Consistent but vaguely stated logical relationship	.08	.04
Conclusion about a cause - effect relationship that was developed over several sentences.	.06	0
Inappropriate justification	.17	.22
Adversatives - Total number of correct responses	45	46
Comparison or contrast with information in the prior sentence; unexpected information	.84	.91
Restriction of the scope of the prior sentence	.09	.04
Inappropriate justification	.04	.02
Sequentials - Total number of correct responses	44	44
Introduces new or next point	.77	.75
Temporal relation	0	0
Sums up prior or previews subsequent information	.20	.23
Inappropriate justification	0	0
Miscellaneous (exclusion, guessing, restating text)	.03	.03

[a]See Appendix A for a full description of the justification categories.

Table 8

Proportions of Justifications in each Category for Incorrect Responses in Experiment 1

Type of Incorrect Response Being Justified	Frequency	Justification Appropriate to: Additive	Causal	Adversative	Sequential	Misc.
Additive						
Native English	14	.14	.57	.07	.21	0
ESL	23	0	.65	.13	.09	.13
Causal						
Native English	9	.44	.22	.11	0	.22
ESL	32	.44	.22	.09	.16	.09
Adversative						
Native English	16	.13	.56	.06	.25	0
ESL	32	.34	.34	0	.13	.19
Sequential						
Native English	17	.24	.35	0	.24	.18
ESL	35	.34	.23	.11	.09	.23

Table 9

Characteristics of the Students in Experiment 2[a]

Characteristic	Mean	Range
Age	18.9	17 - 24
Scholastic Aptitude Test (Verbal)[b]	568.27	440 - 700
Social Science Courses in High School or College[b]	3.03	0 - 13
Major Field of Study		
Social Science	43%	
Natural Science, including Engineering	22%	
Undecided	28%	

[a] All data are self-reported. We did not have access to official student records.

[b] 29 Native English speakers reported verbal Scholastic Aptitude Test scores.

Table 10

Mean Number Correct on each Type of Connector and Mean Confidence Ratings for Correct Items in Experiment 2[a]

Connector	Mean Correct	Mean Confidence Rating for Correct
Additive	5.88	5.54
Causal	6.66	5.67
Adversative	5.63	5.98
Sequential	5.22	5.97

[a]The means are based on 32 subjects and the maximum score was 8 for correct responses. Confidence ratings are on a 7-point scale with 1 = very low confidence and 7 = very high confidence.

Table 11

Distractor selections and mean confidence ratings in Experiment 2

Distractor	Proportion of Incorrect Responses[a]	Mean Confidence Rating for Incorrect[b]
Additive	.27	5.04
Causal	.42	5.39
Adversative	.13	5.07
Sequential	.16	4.97

[a]The mean errors per subject was 8.62 out of a maximum of 32. The Anova was conducted on the arcsine transformations of the proportion of incorrect responses. The means of the transformed proportions were as follows: additive = 1.06; causal =1.44; adversative = .68; sequential = .77.

[b]The means for the confidence ratings were based on a 7-point scale with 1 = very low confidence and 7 = very high confidence. The means are based on 21 subjects because 11 did not have data in all 4 cells.

Table 12

The Proportion of Errors on each Connector Type Accounted for by each of the Distractor Options in Experiment 2[a]

	Distractor Options			
Correct Connector	Additive	Causal	Adversative	Sequential
Additive	- - -	.60	.13	.26
Causal	.27	- - -	.27	.44
Adversative	.46	.42	- - -	.11
Sequential	.37	.42	.20	- - -

[a]The proportions are based on the total number of errors for each connector type. The number of errors were the following: On additive slots, 68; on causal, 43; on adversative, 76; and on the sequential, 89.

Table 13

Student Selection Rate Distributions for Experiment 2

Connector	Percentage of Selections[a]	Percentage of Selections Scored as Correct	Mean Confidence for Correct Responses
Additives	26	70	5.54
Causals	32	66	5.64
Adversative	21	82	5.96
Sequential	21	79	5.97

[a]Total number of selections was 1024.

Table 14

Characteristics of the Students in Experiment 3[a]

Characteristic	Mean	Range
Age	27.8	19 - 65
Age at which school ing in English began	20.6	3 - 60
Stanford Diagnostic Reading Test, Grade Equivalent	5.30	2.7 - 10.6
Social Science Courses in High School or College[b]	2.34	0 - 28
Native Language		
Spanish	48.5%	
European (except Spanish)	8.5%	
Asian	43.0%	

[a]Data are self-reported except for the Stanford Diagnostic Reading Test (SDRT) Brown, Form A. The SDRT is administered by the community college for placement purposes when students enroll. Scores were available on all students. Only 2 students reported a TOEFL score

[b]Only 15 of the 35 students had taken courses related to Social Sciences in High School and only 9 had taken such courses in community college.

Table 15

Instances of Connectors and Frequency of Usage as Correct Responses for the Passages used in Experiment 3

Additive		Adversative		Causal		Sequential	
in fact	1	in contrast	1	thus	1	first	1
for example	1	however	1	as a result	2	next	1
for instance	1	on the other hand	1	hence	1	briefly	2
also	1	in comparison	1	as a consequence	1	third	1
moreover	1	nevertheless	1	consequently	1	later	1
as an example	1	yet	1	therefore	1	second	1
that is	1	nonetheless	1	for this reason	1	in short	1
furthermore	1	rather	1				

Table 16

Mean Probability of a Correct Response, Mean Number Correct, and Mean Confidence Ratings for Correct items in Experiment 3[a]

Connector	Mean Probability	Mean Number Correct	Mean Confidence Ratings for Correct[b]
Additive	.61	4.87	5.11
Causal	.53	4.72	4.92
Adversative	.46	3.76	4.99
Sequential	.39	2.89	5.21

[a]The maximum number correct was 8 per connector type, except for the sequential connector. The maximum correct for the sequential connector was 7.46 because for 19 of the students one of the sequential slots was discounted due to a typographical error in the passage. The error was corrected for the other 16 students. The data for probability and mean number correct are weighted appropriately. Due to this experimenter-error, the ANOVA was done on the probability correct scores.

[b]The means are based on the 32 students who had at least one correct response for each of the connectors. Confidence ratings are based on a 7-point scale with 1 = very low confidence and 7 = very high confidence.

Table 17

Distractor Selections and Mean Confidence Ratings in Experiment 3

Distractor	Proportion of Incorrect Responses[a]	Mean Confidence Rating for Incorrect[b]
Additive	.25	4.76
Causal	.39	4.63
Adversative	.20	4.82
Sequential	.13	4.50

[a]The mean errors per subject was 15.77 out of a maximum of 32 The Anova was conducted on the arcsine transformations of the proportion of incorrect responses. The means of the transformed proportions were as follows: additive = 1.05; causal = 1.36; adversative = .91; sequential = .72.

[b]Three subjects did not have data in all 4 cells and the means are based on 32 subjects. Confidence ratings were based on a 7-point scale with 1 = very low confidence and 7 = very high confidence.

Table 18

The Proportion of Errors on each Connector Type Accounted for by each of the Distractor Options for Experiment 3[a]

	Distractor Options			
Correct Connector	Additive	Causal	Adversative	Sequential
Additive	- - -	.50	.39	.10
Causal	.45	- - -	.37	.17
Adversative	.28	.44	- - -	.26
Sequential	.27	.53	.19	- - -

[a]The proportions are based on the total number of errors for each connector type. The number of errors were the following: On additive slots, 108; on causal, 132; on adversative, 152; and on the sequentials, 170. The number of possible errors was 280 for all but the sequential slots, which had a maximum of 261.

Table 19

Student Selection Rate Distributions for Experiment 3

Connector	Percentage of Selections[a]	Percentage of Selections Scored as Correct	Mean Confidence for Correct Responses
Additives	29	53	5.27
Causals	34	42	5.02
Adversative	23	51	5.09
Sequential	16	57	5.14

[a]Total number of selections was 1098, representing 32 blanks for 16 subjects and 31 for 19 subjects, less three instances of no response.

Table 20

Proportions of Justifications in each Category for Correct Responses in Experiment 3

Connector and Justification Category[a]	
Additives - Total number of correct responses	61
Information gives example of concept	.44
Information elaborates prior information	.31
Inappropriate justification	.11
Causals - Total number of correct responses	48
Cause - effect relationship between the two sentences	.54
Consistent but vaguely stated logical relationship	.06
Conclusion about a cause - effect relationship that was developed over several sentences.	0
Inappropriate justification	.15
Adversatives - Total number of correct responses	47
Comparison or contrast with information in the prior sentence; unexpected information	.66
Restriction of the scope of the prior sentence	0
Inappropriate justification	.19
Sequentials - Total number of correct responses	34
Introduces new or next point	.26
Temporal relation	.26
Sums up prior or previews subsequent information	.12
Inappropriate justification	.03
Miscellaneous[b] (exclusion, guessing, restating text)	.37

[a]See appendix for full description of the justification categories. (table continues)

Table 20 (cont'd.)

[b]Miscellaneous did not differ by connector type and the .37 represents the rate of this response over all connector types.

For !ncorrect Cloze Completion Choices:

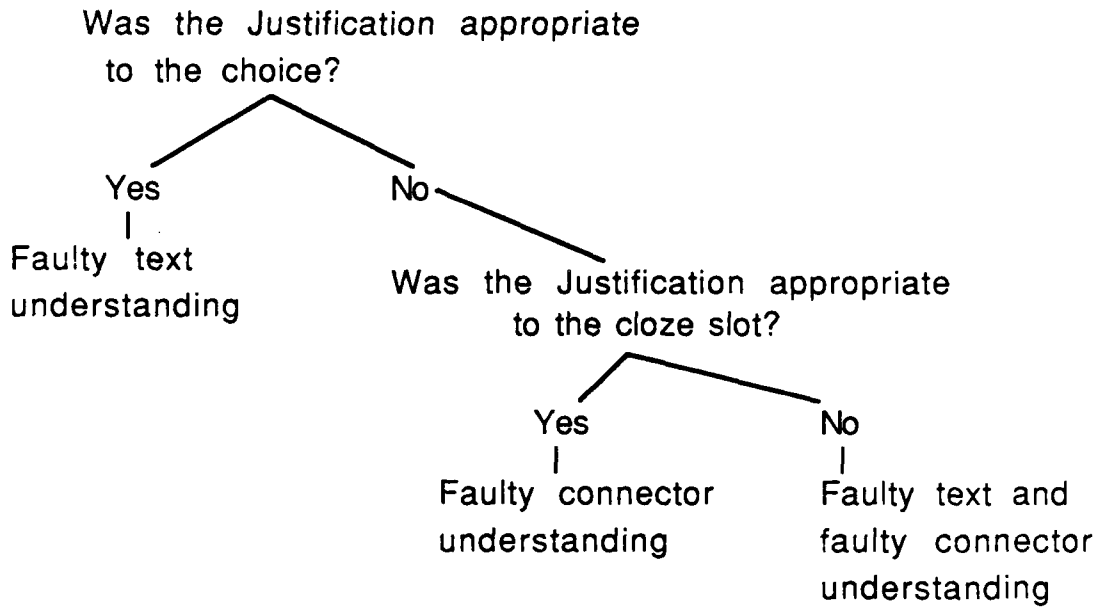

Figure 1: Relationships between incorrect cloze completion and verbal justifications

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